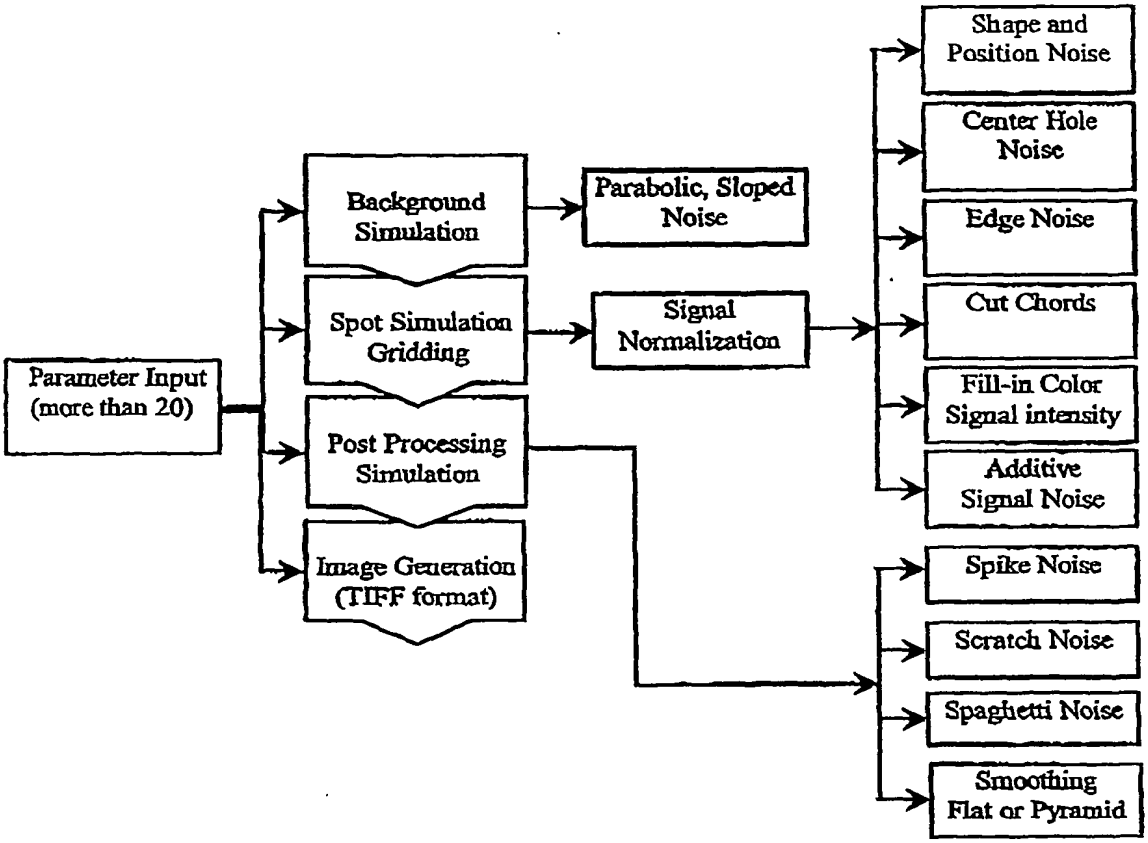

Figure 1. Above figure shows the steps involved in generating the microarray

FIG. 2

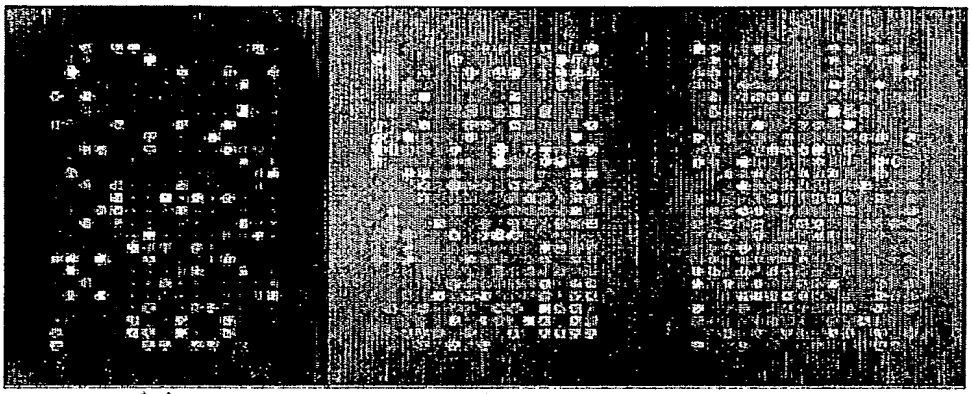

Figure 2. Above figures shows various background noises. The mean SNR is set at 1.0 for the above slides. The slides have following settings (a) Parabolic back ground noise (b) Positive slope background (c) Negative slope background all with global noise parameter. The background deviation factor is set at $k_{b_1} = k_{b_2} = 10\%$

FIG. 3

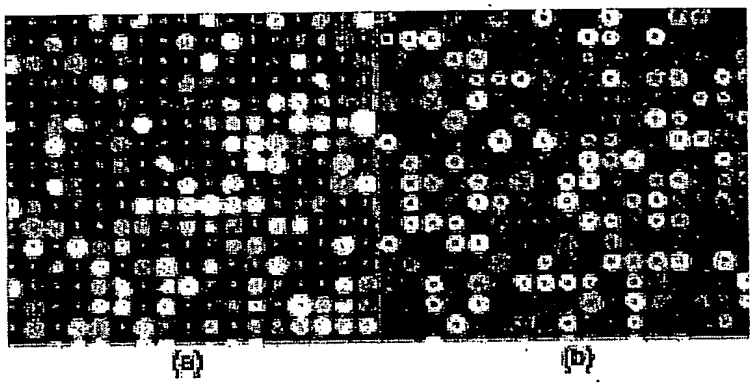

Figure 3. Above example shows different noise settings for spots inner hole. Where (a) uses global background parameter to fill the center hole, (b) uses local background for filling the center hole. The background noise is set to sloped type with SNR of 1.5

FIG. 4

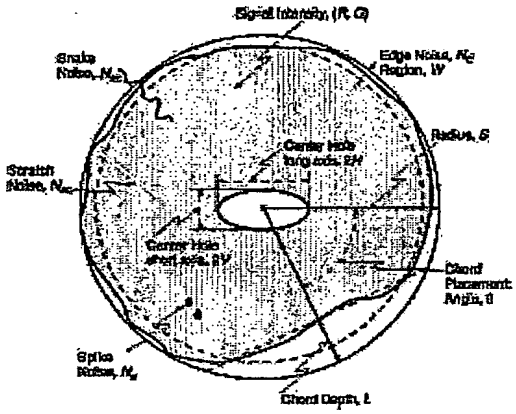

Fig. 4 cDNA microarray spot model.

FIG. 5

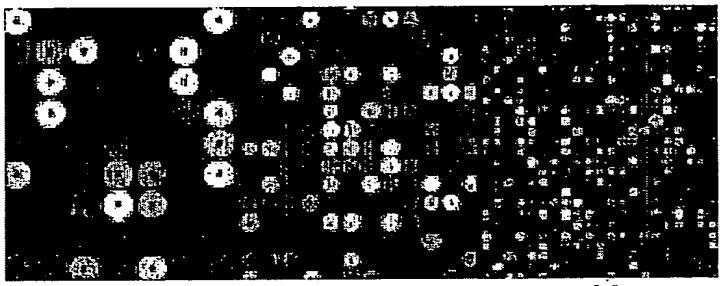

Figure 5. Above figure shows the variability in spot size and spread from its size. The spot radius distribution is automatically set depending on the number of spots in a block (width, height). In the above example has (a) (10,15), $\mu_S \sim U[23.3\ 24.3]$, (b) (20,25), $\mu_S \sim U[12.6\ 13.6]$ and (c) (25,45), $\mu_S \sim U[5.45\ 6.45]$, with standard deviation k_s = 1%, 7%, 20% of radius respectively

FIG. 6

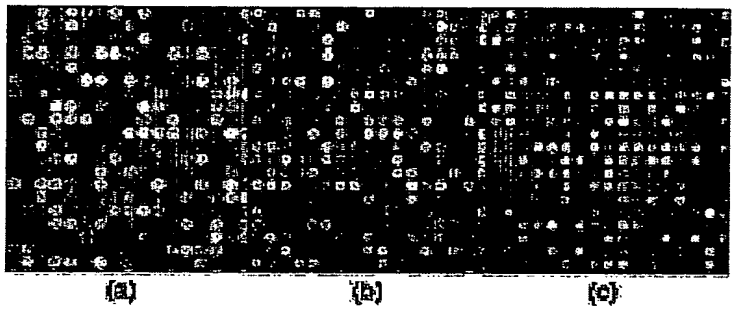

Figure 6. Above figure shows inter-spot grid spacing (a) G_{sp} = 3 pixels, μ_S ~U[9.5 10.5], (b) G_{sp} = 6 pixels, μ_S ~U[8 9] (c) G_{sp} = 10 pixels, μ_S ~U[6.5 7.5]. The above example has (35, 20) rows, columns respectively with k_s = 0.05

FIG. 7

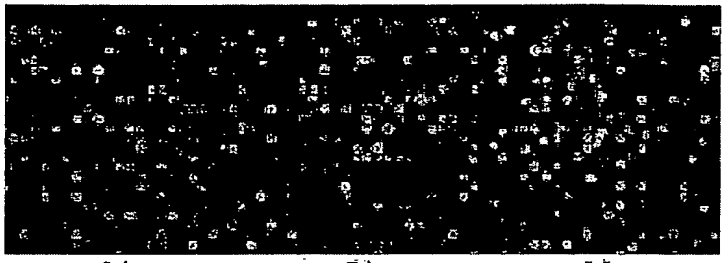

Figure 7. Above figure shows the effect of radius drift variation (P_d, R_{d1}, R_{d2}). Above examples has following settings (a) (0.05, 5, 100), (b) (0.25, 15, 100), (c) (0.5, 50, 100). As the activation probability with drift range is set higher, the spots drifts away from its center

FIG. 8

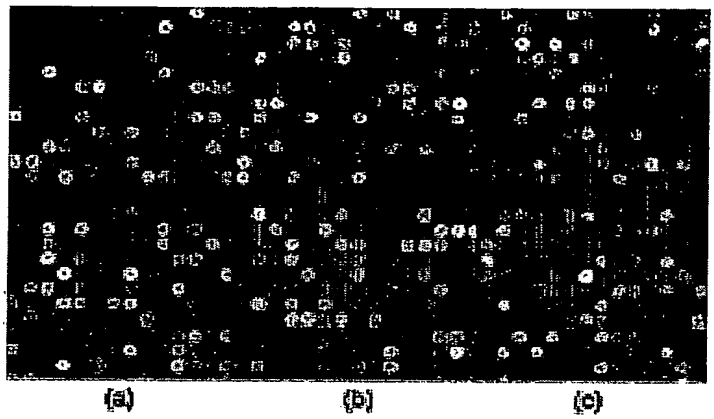

Figure 8. Above figure shows different chord rate settings for each of the slide. The probability weights for (0,1,2,3,4) chords was set at following levels. (a) (0.7, 0.3, 0.0, 0, 0) (b) (0.2, 0.4, 0.25, 0.15, 0) (c) (0.0, 0.1, 0.4, 0.3, 0.2) respectively. Chord rate is reset at the beginning of a block.

FIG. 9

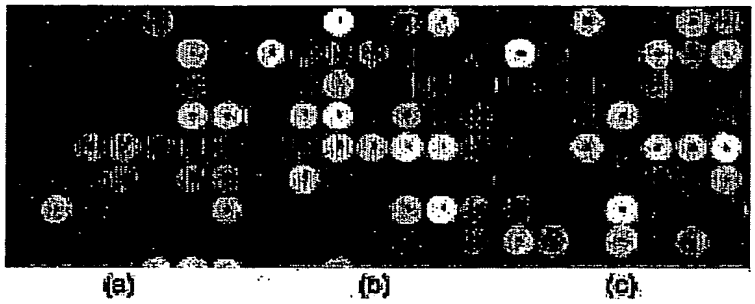

Figure 9. Figure shows the edge noise on the spots. Noise controlling parameter (δ) can be set from [0, 1.0]. Above example shows an increased edge noise effect, where (a) δ = 0.25, (b) δ = 0.1 (c) δ = 0.03

FIG. 10

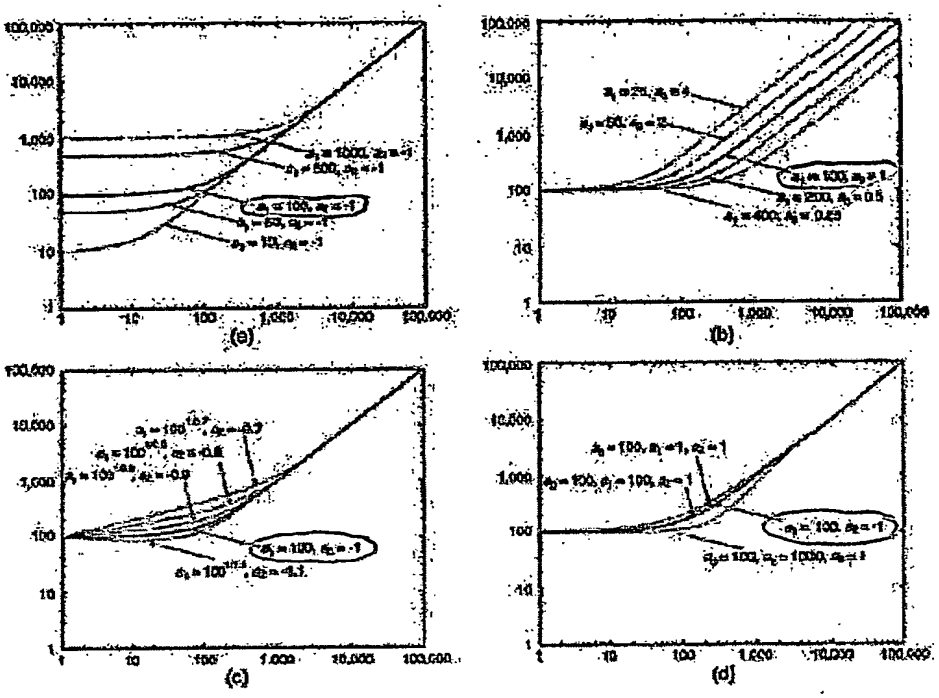

Figure 10. Fluorescent detection response characteristic functions. In all figures, middle (blue) curve is the reference function with parameters of (a_0, a_1, a_2, a_3) = (0, 100, -1, 1). Also, in all figures, the *x*-axis is the input signal intensity, and *y*-axis is the observed signal intensity, and both are in $\log_{10}$-scale. (a) Delayed response at various levels, with fixed $a_0 = 0$ and $a_3 = 1$. (b) Different amplification levels, with fixed $a_0 = 0$ and $a_2 = -1$. (c) Different response curvature, with fixed $a_0 = 0$ and $a_3 = 1$. (d) Some other parameter settings, with fixed $a_3 = 1$.

"Blue" curve is circled.

FIG. 11

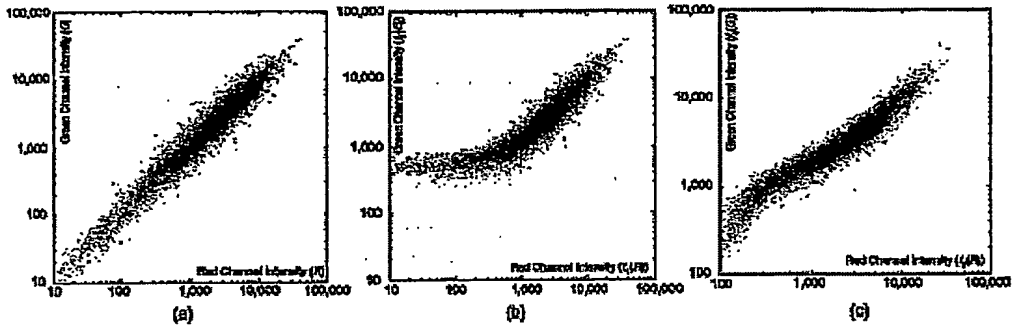

Figure 11. Possible scatter plot due to various response conversions for different fluorescent channels. 10,000 Data points (gene expression levels) were generated by the exponential distribution with mean of 3000. After passing through two fluorescent channels (with some response characteristic functions as shown in parts (a) to (c)), data variations were added by passing each data point through a normal distribution with the standard deviation to be 15% of mean expression signal. (a) Without any alteration (or equivalently, set parameters for the response function to be $(a_0, a_1, a_2, a_3) = (0, 1, -1, 1)$), and assume the signal intensities from red channel and green channel are equivalent (a simulated self-self experiment). (b) Banana-shape. Intensity in green channel pass a response function with parameters $(a_0, a_1, a_2, a_3) = (0, 500, -1, 1)$, where red channel takes the parameters (0, 10, -1, 1). (c) Sinusoid-shape. The red channel's response function with parameters $(0, 100^{1/0.7}, -0.7, 1)$, and the green channel with $(0, 100^{1/0.9}, -0.9, 1)$.

FIG. 12

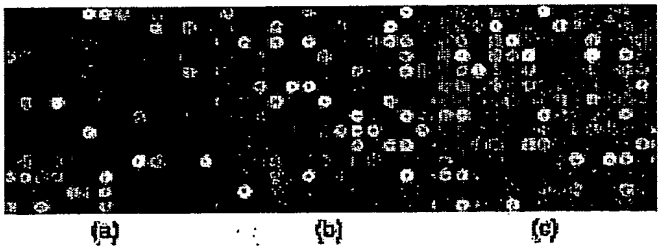

Figure 12. Above figure shows increased spike noise levels L_{spk}. (a) level of 0.1 %, (b) level of 5%, (c) level of 10% , exponential rate range is maintained for the above

FIG. 13

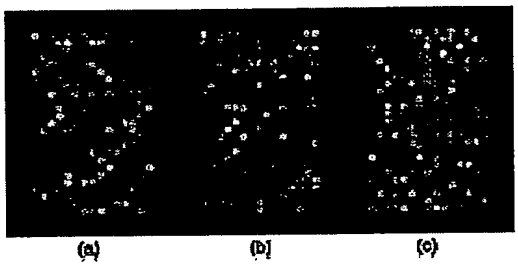

Figure 13. Figure shows scratch noise with its parameter settings. Number of scratches is maintained to 7 in the above examples. Following are the parameter (a) $L_{sc} \sim U[2\ \ 7]$, $\kappa_{sc} = 1.5$, $W_{sc} = 3$ pixels, (b) $L_{sc} \sim U[5\ \ 15]$, $\kappa_{sc} = 2.5$, $W_{sc} = 7$ pixels, (c) $L_{sc} \sim U[8\ \ 45]$, $\kappa_{sc} = 4.0$, $W_{sc} = 15$ pixels. The noise factor $k_{sc} = 0.1$.

FIG. 14

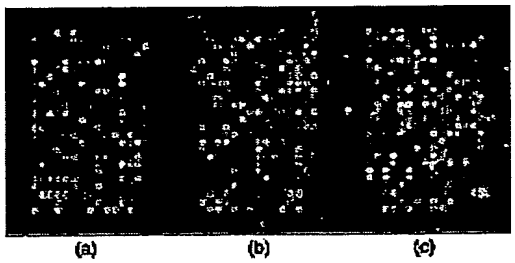

Figure 14. Above example shows different parameter setting for snake noise. In this example (a) N_{seg} =5, $L_{sp} \sim U[5\ 10]$, $\kappa_m = 0.5$, W_{sp}= 2 pixels (b) N_{seg} =10, $L_{sp} \sim U[5\ 30]$, $\kappa_m = 0.33$, W_{sp}= 3 pixels, (c) N_{seg} =15, $L_{sp} \sim U[5\ 80]$, κ_m =0.25, W_{sp}= 5pixels respectively. Direction of the tail was randomly chosen with equal probability for each.

FIG. 15

1	1	1
1	1	1
1	1	1

(a)

0.5	1	0.5
1	2	1
0.5	1	0.5

(b)

Fig. 15 Example shows the 3×3 convolution kernel for (a) flat function and (b) pyramidal function.

FIG. 16

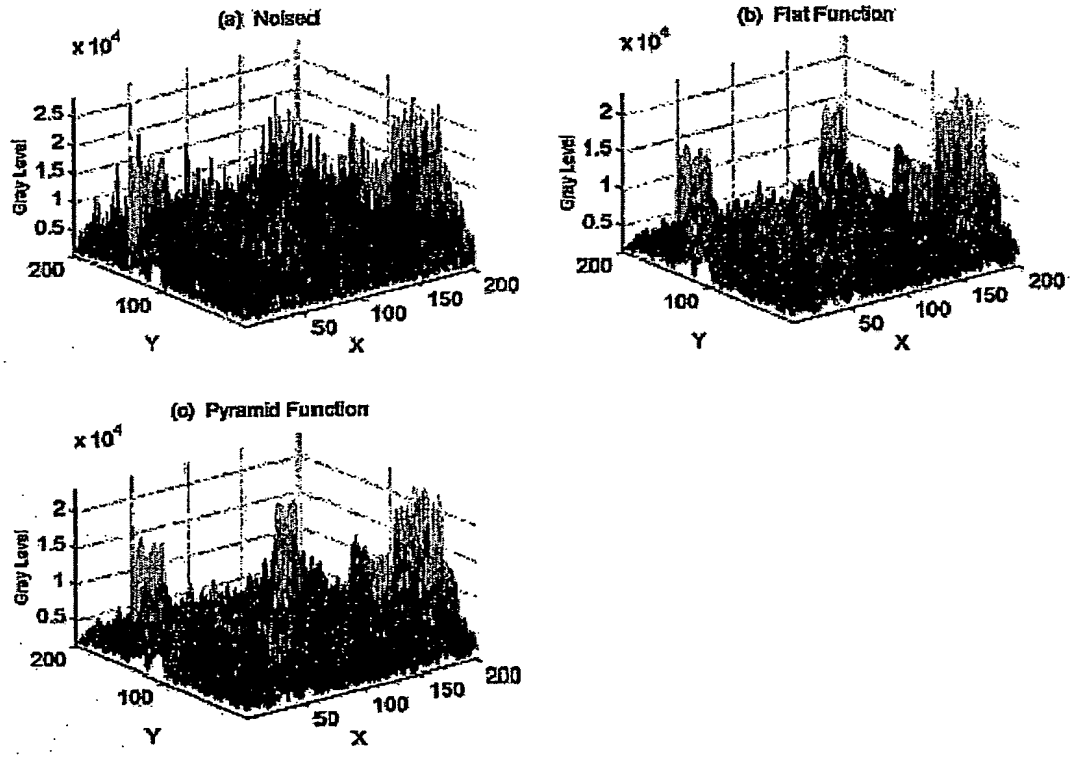

Fig. 16 Example shows the 3D profile before and after smoothing. Where (a) noised, (b) flat function, (c) pyramid function.

FIG. 17

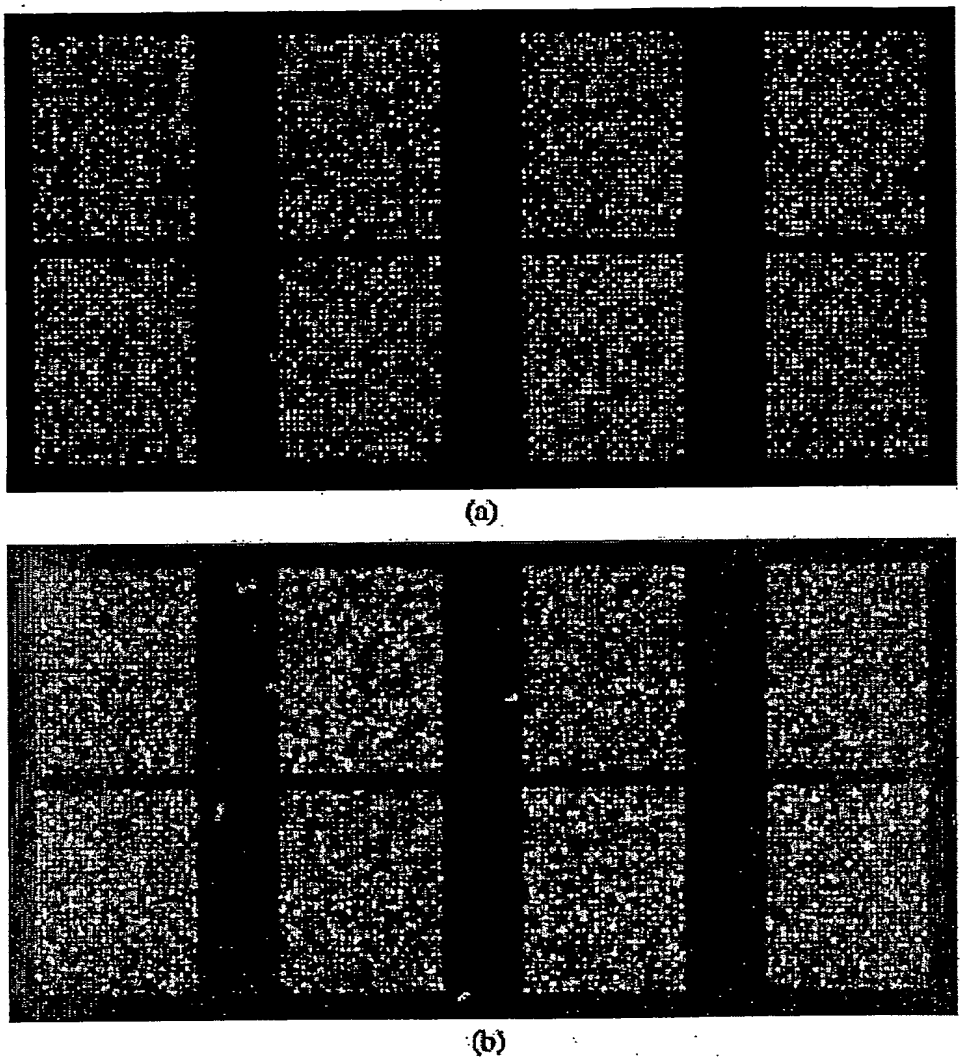

Figure 17. This example shows full size arrays simulation with different parameter settings. Depending on the parameters the arrays are called as average and noisy in quality (a) good quality has SNR of 2.0, with normal background, spike noise L_{spi} =0.3% (b) noisy array with SNR of 1.1 with parabolic background noise, spike noise L_{spi} = 15%.

FIG. 18

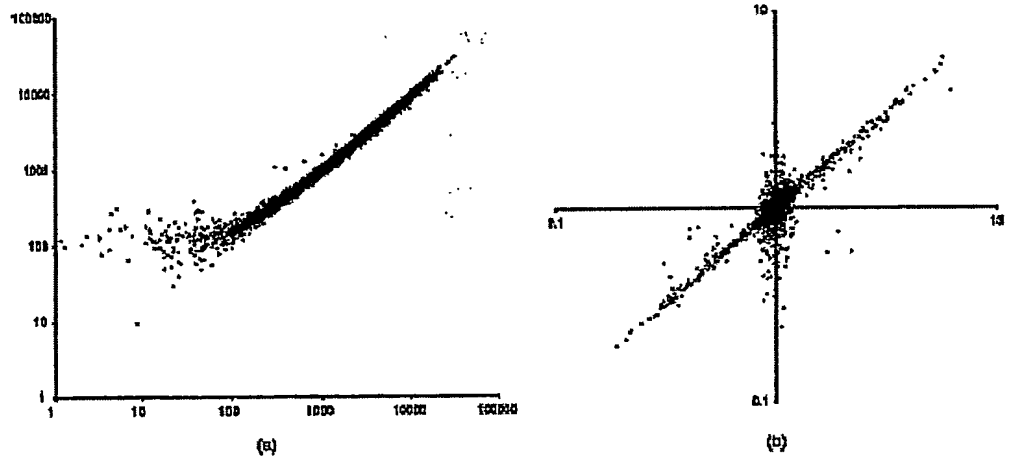

Figure 18. Comparison between simulated signal (ideal setting) vs. extracted signal from microarray image analysis program. (a) Signal extracted from one fluorescent channel (y-axis) comparing to the signal used for simulation in the same channel (x-axis). (b) Ratios from microarray image analysis program (y-axis) comparing to the ratios generated by the simulation (x-axis).

FIG. 19

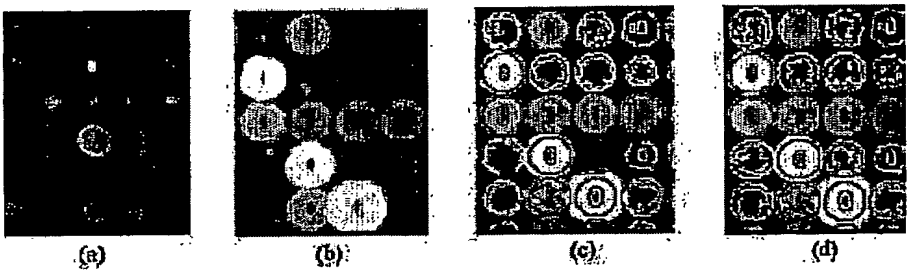

Figure 19: (a) part of actual hybridized image with spots larger than average; (b) simulated microarray with larger spots and spots overlapping with their neighbors; (c) original background intensity extraction program produces undetected spot (target in the middle without outer boundary); (d) improved background extraction program more accurately measures the local background intensity and effectively allows detection of weak targets.